

**WHAT IS CLAIMED IS:**

1. An illumination optical system for  
illuminating an object surface, said illumination  
5 optical system comprising an optical unit that converts  
light from a light source section into approximately  
parallel light, and includes first and second mirrors,  
wherein the first mirror has an opening, through which  
light reflected by the second mirror passes.

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2. An illumination optical system according to  
claim 1, further comprising:

a reflection integrator for forming plural  
secondary light sources using light from said optical  
15 unit; and

a mirror unit for superimposing light from  
the plural secondary light sources onto the object  
surface.

20 3. An illumination optical system according to  
claim 1, wherein the opening is located at a center of  
the first mirror.

4. An illumination optical system according to  
25 claim 1, wherein the opening is on an optical path of  
the optical unit.

5. An illumination optical system according to claim 1, wherein the light source section includes a condenser mirror, and the opening is located on an optical axis of the condenser mirror.

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6. An illumination optical system according to claim 1, wherein the first mirror is a concave mirror, and the second mirror is a convex mirror.

10 7. An illumination optical system according to claim 2, wherein the integrator has a reflective surface with plural convex or concave cylindrical surfaces or a combination thereof.

15 8. An illumination optical system according to claim 1, wherein the first and second mirrors have a cooling mechanism that includes a channel that flows coolant.

20 9. An illumination optical system according to claim 6, further comprising two or more rods for fixing the convex mirror, at least two of the rods having a channel that flows coolant.

25 10. An illumination optical system according to claim 2, wherein said mirror unit has an arc forming

optical unit for condensing light from the secondary light sources into an arc illuminated area.

11. An illumination optical system according to  
5 claim 10, wherein the arc forming optical unit includes a curved mirror that has a focal point near a reflective surface of the integrator, and at least one mirror, light incident upon the curved surface having an angle of  $45^\circ$  or smaller.

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12. An illumination optical system according to claim 11, wherein the curved mirror is a rotational paraboloid mirror.

15 13. An illumination optical system according to claim 11, wherein the angle is  $20^\circ$  or smaller.

14. An illumination optical system according to claim 10, wherein the mirror unit includes:

20 an arc stop that has an arc opening arranged at or near a surface on which the arc illuminated area is formed;

a masking blade; and

a masking imaging unit for enlarging or  
25 reducing the arc opening at a predetermined magnification and for imaging the arc opening onto the object surface.

15. An illumination optical system according to claim 1, wherein the light source section includes a condenser mirror, and

wherein said illumination optical system  
5 further comprises an aperture having a pinhole,  
arranged near a condensed point of the condenser mirror  
of the light source section.

16. An illumination optical system comprising an  
10 optical unit that converts light from a light source  
section into approximately parallel light, and includes  
plural mirrors and optical axis, wherein the light  
source section includes a condenser mirror, and the  
optical axis accords with that of the condenser mirror.

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17. An illumination optical system comprising an  
optical unit that converts light from a light source  
section into approximately parallel light, and includes  
plural mirrors and an optical axis, wherein the light  
20 source section includes an emission point that is  
located on or near the optical axis.

18. An exposure apparatus comprising:  
an illumination optical system for  
25 illuminating a mask that forms a pattern, said  
illumination optical system including an optical unit  
that converts light from a light source section into

approximately parallel light, and includes first and second mirrors, wherein the first mirror has an opening, through which light reflected by the second mirror passes; and

- 5                   a projection optical system for projecting the pattern on the mask onto a substrate.

19. An exposure apparatus comprising:

- an illumination optical system for  
10   illuminating a mask that forms a pattern, said illumination optical system including an optical unit that converts light from a light source section into approximately parallel light, and includes plural mirrors and optical axis, wherein the light source  
15   section includes a condenser mirror, and the optical axis accords with that of the condenser mirror; and  
                  a projection optical system for projecting the pattern on the mask onto a substrate.

20                  20. An exposure apparatus comprising:

- an illumination optical system for  
          illuminating a mask that forms a pattern, said illumination optical system including an optical unit that converts light from a light source section into  
25   approximately parallel light, and includes plural mirrors and an optical axis, wherein the light source

section includes an emission point that is located on or near the optical axis; and

a projection optical system for projecting the pattern on the mask onto a substrate.

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21. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

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developing the exposed object,

wherein said exposure apparatus includes:

an illumination optical system for illuminating a mask that forms a pattern, said illumination optical system including an optical unit that converts light from a light source section into approximately parallel light, and includes first and second mirrors, wherein the first mirror has an opening, through which light reflected by the second mirror passes; and

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a projection optical system for projecting the pattern on the mask onto a substrate.

22. A device fabricating method comprising the steps of:

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exposing an object using an exposure apparatus; and

developing the exposed object,

wherein said exposure apparatus includes:  
an illumination optical system for  
illuminating a mask that forms a pattern, said  
illumination optical system including an optical unit  
5 that converts light from a light source section into  
approximately parallel light, and includes plural  
mirrors and optical axis, wherein the light source  
section includes a condenser mirror, and the optical  
axis accords with that of the condenser mirror; and  
10 a projection optical system for projecting  
the pattern on the mask onto a substrate.

23. A device fabricating method comprising the  
steps of:  
15 exposing an object using an exposure  
apparatus; and  
developing the exposed object,  
wherein the exposure apparatus includes:  
an illumination optical system for  
20 illuminating a mask that forms a pattern, said  
illumination optical system including an optical unit  
that converts light from a light source section into  
approximately parallel light, and includes plural  
mirrors and an optical axis, wherein the light source  
25 section includes an emission point that is located on  
or near the optical axis; and

a projection optical system for projecting  
the pattern on the mask onto a substrate.